NON-PUBLIC?: N
ACCESSION #: 9001120007
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 2 PAGE: 1 OF 05

DOCKET NUMBER: 05000410

TITLE: Reactor Scram on High Neutron Flux Due to Electrohydraulic
Control System Malfunction
EVENT DATE: 12/01/89 LER #: 89-040-00 REPORT DATE: 01/02/90

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FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 097

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Robert G. Smith, NMP2 TELEPHONE: (315) 349-2388
Superintendent of Operations

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 1, 1989, Nine Mile Point Unit 2 (NMP2) was operating at approximately 97% rated thermal power with the mode switch in the "RUN" position (Operational Condition 1). At 1310 hours, NMP2 experienced an automatic Reactor Scram caused by Average Power Range Monitor (APRM) high neutron flux signals on both divisions of the Reactor Protection System (RPS). At 1313 hours, the turbine was tripped on reverse power by the main generator antimotoring device.

Immediate corrective actions were taken by Operations to carry out all scram recovery actions and to place the plant in a stable "HOT SHUTDOWN" mode (Operational Condition 3). Operations then initiated an investigation of the event.

The immediate cause was a malfunction of the Electrohydraulic Control System (EHC) which resulted in the power transient that caused the scram.

Corrective action was to replace 3 relay boards in the EHC control circuit and correct a ground loop in the turbine speed sensing circuit.

END OF ABSTRACT

I. DESCRIPTION OF EVENT

On December 1, 1989, Nine Mile Point Unit 2 (NMP2) was operating at approximately 97% rated thermal power (1085 MWe) preconditioning towards full power. At 1310:55 hours, with the mode switch in the "RUN" position (Operational Condition 1), all five Turbine Bypass Valves went to the full open position and all four Turbine Control Valves began to ramp closed which caused an increase in reactor pressure. At 1310:56 hours, the resultant pressure increase caused reactor power to increase and caused an automatic reactor scram due to the Average Power Range Monitor (APRM) high neutron flux signals.

Immediately after the scram, reactor pressure momentarily increased to 1045 psig, activating the Redundant Reactivity Control System (RRCS) alternate rod insertion and recirculation pump downshift signals. Reactor water level decreased below the Level 3 setpoint (159 inches) to 147 inches due to void collapse. Reactor water level then momentarily recovered above the Level 7 setpoint (187 inches) to 191 inches, resulting in a high level alarm due to the resulting swell, and was then controlled at approximately 170 inches. There were no Emergency Core Cooling System (ECCS) or Safety Relief Valve (SRV) actuations. The Turbine Bypass Valves reclosed at 1311:18 hours when the turbine throttle pressure reached 915 pounds per square inch gauge (psig). The turbine remained in operation until 1313:34 hours, when it was tripped on reverse power by the main generator antimotoring device.

The plant operators then proceeded to place the unit in a stable "HOT SHUTDOWN" mode (Operational Condition 3). The duration of the event was approximately 3 minutes and 20 seconds. Operations then initiated an investigation to determine the cause of scram.

There were no inoperable systems or components that contributed to this event.

II. CAUSE OF EVENT

The immediate cause of the event was a malfunction of the turbine Electrohydraulic Control System (EHC). The cause of the malfunction (intermediate cause) was a sudden zero voltage input to the control valve demand signal.

A root cause analysis was performed using Site Supervisory Procedure S-SUP-1, "Root Cause Evaluation Program". The results of this analysis failed to establish a root cause. Two possible causes were identified during subsequent troubleshooting.

At the time of the event, there was no work in progress that may have affected the EHC system. There were no radio transmissions in the relay room that may have affected EHC circuits. The bypass valves fast opened and the control valves ramped closed. Using this information, tests were performed which simulated the EHC control signals to try to duplicate the event response.

One possible cause is component failure. This was arrived at by noting that by placing a zero voltage on the control valve demand signal, a response similar to that recorded during the scram could be simulated. The sudden zero voltage input to the control valve demand signal may be caused by one of the following relays:

1. Shell warming mode input signal (Relay K7D10)
2. Turbine stop valves less than 90% open (Relay K2B16)
3. Turbine trip signal as sensed by emergency trip pressure switches (Relay K4D27)

These three mercury wetted relays have been previously reported in industry literature as having a potential of failure by forming a bridge between the contacts.

The other possible cause was due to an installation error. While installing a new temporary monitoring panel (located on elevation 306 of the Turbine Building) for turbine vibration/frequency/reverse sequence current, contractor personnel connected the turbine speed sensing cable to a filter/pre-amplifier. This filter/pre-amplifier had been installed on the old equipment being replaced but was not covered in the engineering documents for the new equipment. When the filter/pre-amplifier was connected, the shield for the speed signal was erroneously connected to ground through the filter/pre-amplifier case. This connection of the shield to ground at the monitoring equipment caused a ground loop as the other end of the shield was grounded, per design, in the EHC cabinet (2CEC-PNL843; elevation 288; Control

Building).

The temporary monitoring equipment was installed to perform torsional testing of the main turbine. The results of the torsional test indicate that the turbine operates near the turbine resonant frequency. The monitoring equipment was left in place to provide monitoring of

vital parameters to assure the turbine is operated above the resonant frequency. The new equipment installed by contractor personnel provides a local alarm and easier retrieval of data. The new equipment was installed the morning of 12/01/89.

The ground loop was discovered when operations personnel attempted to place the turbine in shell warming on 12/07/89. At this time Turbine Control Valves failed to operate properly. Troubleshooting of this problem resulted in identification of noise being imposed on the turbine speed signal to EHC. This noise was found to be caused by the ground loop.

A review of data taken after the reactor scram and prior to the turbine trip indicates that noise was present on the Combined Intercept Valves (CIV's). EHC control circuit drawings indicate that this noise could have been seen on the control valves also. This noise could have caused the event, provided the noise signal was of large magnitude (i.e., larger than the turbine speed reference signal), and was present for about 20 seconds (the amount of time the bypass valves remained open).

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73 (a)(2)(iv) which requires the licensee to report "Any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS) ."

There were no adverse safety consequences as a result of this event. The response of the plant during this event was bounded by the Generator Load Rejection Event which is analyzed in Chapter 15 of the Updated Safety Analysis Reports (USAR).

IV. CORRECTIVE ACTIONS

Immediate corrective actions were taken by operation to place the plant in a stable "Hot Shutdown" mode (Operational Condition 3).

Work Request 170528 was issued to investigate the Electrohydraulic Control (EHC) system malfunction. A thorough review of the relays that could have caused the zero voltage on the control valve demand signal

was performed. The following three possible affected relay boards were replaced:

Slot B16 Part Number 996D957G2
Slot D10 Part Number 947D396G2
Slot D27 Part Number 947D396G1

Work Request 170714 was used to troubleshoot the grounding loop in the turbine speed sensing circuitry from the EHC system. The cable shield was disconnected from ground on the turbine monitoring equipment which eliminated the ground loop.

Additionally, a Lessons Learned transmittal is being prepared to discuss the incident that caused the installation error, and to provide greater clarification of the role of NMPC personnel in directing contractor personnel.

V. ADDITIONAL INFORMATION

A. Failed components: under investigation.

B. Previous similar events: none.

C. Identification of components:

IEEE 803 IEEE 805
COMPONENT EIIS FUNCTION SYSTEM ID

Average Power Range Monitor (APRM) NA IG

Reactor Protection System (RPS) NA JC
Electrohydraulic Control System (EHC) NA TG
Turbine Control Valves (TCV) NA TG
Turbine Bypass Valves (TBV) NA JI
Redundant Reactivity Control System NA JC
(RRCS)

NIAGARA MOHAWK

NINE MILE POINT NUCLEAR STATION/P.O. BOX 32, LYCOMING, N.Y. 13093/
TELEPHONE (315) 343-2110

NMP60660

January 2, 1990

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

RE: Docket No. 50-410
LER 89-40

Gentlemen:

LER 89-40 Which is being submitted in accordance with 10CFR50.73 (a)(2)(iv), "Any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

A 10CFR50.72 report was made at 1532 hours on December 1, 1989.

This report was completed in the format designated in NUREG-1022, Supplement 2, dated September 1985.

Very truly yours,

J. L. Willis
General Superintendent
Nuclear Generation

JLW/GB/lmc

ATTACHMENT

cc: Regional Administrator, Region I
Sr. Resident Inspector, W. A. Cook

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